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Listening to the Message of the Black-backed Woodpecker, a Hot Fire Specialist

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Joint Fire Science Program

Fire Science Brief

RESEARCH SUPPORTING SOUND DECISIONS

Fires of 2000 in the Bitterroot Valley, Montana. Credit: John McColgan, BLM Alaska.

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Summary

The Black-backed Woodpecker is an uncommon bird of the northern coniferous forests of North America. It is one of several species of fauna that are considered fire specialists. This woodpecker nests in cavities it creates in dead standing trees and feeds on wood-boring beetles and their larvae, which are also attracted to stressed or burned trees. Because the bird can be seen and heard from a distance, its population dynamics can be used to estimate the suitability of habitat to support both flora and fauna that have evolved in a natural regime of severe fire. In the effort to return the forests to a condition more in tune with historical norms, resource managers will need to embrace the concept that severe, stand-replacing fires that do not threaten life or property are not all bad. They are, in fact, essential for the survival of a variety of fire-dependent species.

Key Findings

- Wildfire is the primary disturbance that has shaped the landscape historically in forests in the northern Rockies.
- Mixed-severity fire, including stand-replacing and moderate events, has been the dominant type of wildfire in northern coniferous forests.
- Evidence is mounting that extreme fire events are not unnatural occurrences.
- Research by wildlife biologists confirms that a number of species, in particular the Black-backed Woodpecker, have evolved along with recurrent, very hot fires.
- Salvage logging after fire can have negative effects on habitat, including nesting and feeding sites, of species such as the Black-backed that are dependent on dead standing trees.

It's only natural

In the western United States, fire ecology research has generally focused on low or medium severity, frequent fires, which were historically the rule and stand replacing fire an exception. The goal of many land managers has been to reduce the fuel load, and thus the risk of severe wildfire, using a variety of treatments—including logging, thinning, and prescribed fire—to mimic the natural fire regime. This approach, however, is not necessarily suited to coniferous forests that support fire specialist birds such as the Black-backed Woodpecker (*Picoides arcticus*), says Richard Hutto, director of the Avian Science Center and professor in the Division of Biological Sciences at the University of Montana. "There is a continuous gradient of fire severity in the southwestern states where stand replacement events were rare," says Hutto. "Once you get into the Northern Rockies, the area with severe fires gets big enough to support a specialist like the Black-backed."

Wildlife like this woodpecker can tell us a lot about historic conditions. "In understanding fire ecology, we haven't paid enough attention to plant and animal species to gain insight into what is natural," says Hutto. Historical evidence gathered from the relatively recent past, such as that provided by tree-ring studies, doesn't always tell a story untainted by human alteration of the natural fire regime. We need to supplement those studies with other approaches that reach farther back in time.

"In understanding fire ecology, we haven't paid enough attention to plant and animal species to gain insight into what is natural"

A hot fire specialist speaks out

The Black-backed Woodpecker is a post-fire specialist in coniferous forests from Alaska to eastern Canada. Its coloration helps it blend in with the charred aftermath of severe fire. If it has been around long enough to adopt this camouflage outfit, what is it saying about the place of intense wildfire in the higher latitude conifer and mixed-conifer forests where it evolved?

The Black-backed is a small bird, about 9 inches long (23 cm), that occupies a very small niche on the ecological landscape, one characterized by intense wildfire. It has a solid black back, white stripes on its sides, and white and gray mustaches. The male also sports a small yellow cap at a rakish angle on its forehead.

The Black-backed Woodpecker depends on severely burned trees for both nesting and feeding. Credit: Richard Hutto.

While this woodpecker may not be as charismatic as the panda or the grizzly bear, its almost complete dependence on hot fire earns it a place as an indicator species. "It's not just about the Black-backed, it's about listening to this woodpecker telling about something bigger than itself, a whole system that depends on fire," says Hutto.

The morel mushroom, for example, a culinary treat prized by wild pickers, likewise thrives after intense fire. Certain insects also love a good hot fire. Fire-dependent beetles, themselves a delicacy for the Black-backed, can sense fire up to 50 miles away, Hutto says, using infrared heat to guide them to their next snack. These insects are so adapted to hot fire that they lay eggs in trees that are still smoldering. Understanding these fire dependent species can help guide our efforts to be good stewards of the landscape, especially on lands that provide a wide variety of ecosystem services such as water quality, air quality, and diversity of wildlife.

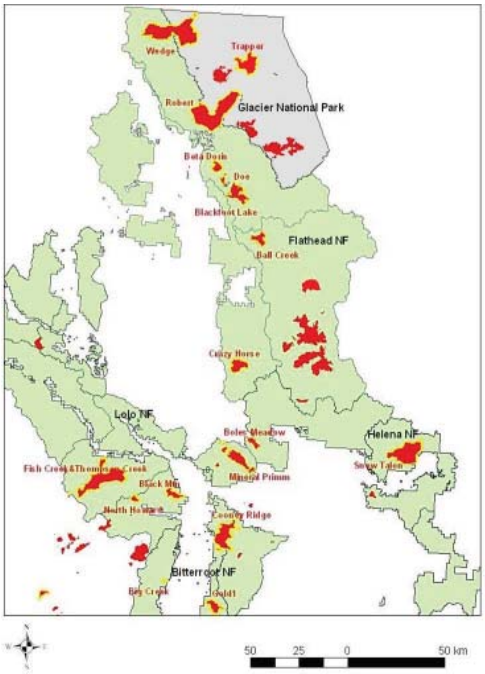
After the fires

Summer of 2003 was an active fire season in western Montana and Alberta, Canada. Nearly 380,000 acres in Montana burned. Though news reports tended to underscore

the catastrophic severity of the fires, researchers seized the opportunity to monitor the presence and abundance after fire of Black-backed Woodpeckers.

Evidence of woodpecker feeding on beetle larvae in ponderosa pine and Douglas-fir forest after a severe fire. Credit: Richard Hutto.

A research project supported by the Joint Fire Science Program (JFSP) with additional funding from the USDA Forest Service began the spring following the fires and continued through 2007. Hutto and colleagues with the Forest Service and Glacier National Park wanted to determine the influence of local and landscape conditions on the occurrence and abundance of Black-backed Woodpeckers in burned forest patches.



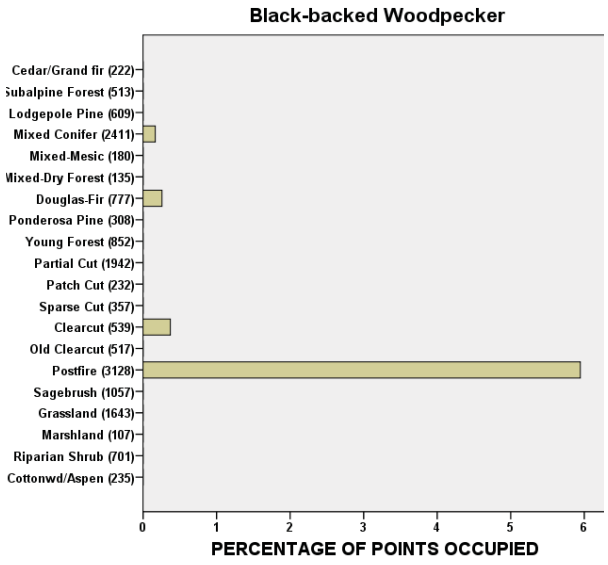
The study area covered 17 sites in western Montana. Credit: JFSP Final Report.

Their study was conducted on 17 fire sites in four National Forests in western Montana—Bitterroot, Flathead, Helena, and Lolo—and in Glacier National Park. The experimental sites consisted of mid-elevation (4,000 feet) conifer and mixed-conifer forest types that had been subjected to two pre-fire treatments, logging with the goal of reducing fuel load or no pre-fire logging. The researchers measured three levels of fire intensity and two regimens of post-fire activity, salvage logging or no salvage logging.

The sampling protocol used, the habitat-based point-count protocol, is the standard adopted by the Northern Region Landbird Monitoring Program (NRLMP) for tallying all landbird species seen or heard at established sites over a period of time. NRLMP is a cooperative effort between the Forest Service and the University of Montana. The protocol has been used to document avian population trends in the Northern Rockies and to correlate those trends with the wide range of habitats in the region, from grassland to subalpine forest. In addition, the program gathers information on the ecological effects of a range of land-use activity. The NRLMP represents one of the largest comparative databases of landbirds in the world. Combining information on the Black-backed Woodpecker with the NRLMP database gathered from more than 50,000 point counts, Hutto found that of more than 100 avian species, the Black-backed Woodpecker is the most fire dependent.

Fire intensity

Results of point counts at more than 1,000 survey sites confirmed that the Black-backed Woodpecker fared better with increasing burn severity. None were observed on unburned sites or low-severity sites in the first two years of the study, though their numbers did increase slightly in years three and four. Their presence on severely burned sites spiked dramatically in the second, third, and fourth years of the study.



Results from more than 13,000 point-count surveys across 20 different vegetation types reveal a remarkable degree of specialization in Black-backed Woodpeckers. Credit: Richard Hutto.

Post-fire salvage logging

Results on the effects of post-fire salvage logging on Black-backed Woodpecker populations over the four-year

period were also dramatic. The probability of Black-backed occurrence drops from 6 percent in unharvested sites to about 4 percent in moderately harvested sites and then to about 3 percent in more intensely harvested sites. "If you do cut the trees out, there goes the Black-backed," says Hutto.

Pre-fire timber harvest

The study also explored the effect of timber harvest on burn sites within a decade or two before the fires. Treatments such as seed tree cuts and shelterwood cuts are standard forestry techniques that have been applied with the goal of forest restoration. In a pattern similar to that found with post-fire harvesting, Hutto found that Black-backed Woodpeckers fared best on sites unharvested before fire and poorest in the heavily harvested sites, raising a concern about logging for forest restoration that has not yet been addressed—how does pre-fire logging affect the future suitability of these forests to post-disturbance specialists.

Glacier National Park

Within the extensive geographic area of the JFSP project, only one study site, Glacier National Park (GNP), is located on land managed by the National Park Service, whose mission is "to promote and regulate the use of the… national parks…which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

"Glacier National Park is the only reference condition we have for comparison with managed forests," Hutto says. Outside the park, the probability of detecting this woodpecker is 4.5 percent on average, while inside the park the probability rises to 10 percent. Clearly, a more hands-off management approach before wildfire affects the suitability of habitat for this fire-dependent species.

Plea for documentation

Across a wide range of forests, from heavily timbered or clear cut to lightly managed or managed not at all, there is an urgent need for careful documentation of past land-use activities. Lack of documentation has resulted in the loss of a gold mine of knowledge that could inform ongoing research on the effects of fire on the landscape. "Most managers, 99 percent, don't keep historical records," Hutto says. In gathering information, according to the JFSP final report, these are the questions land managers need to ask: When was the forest cut? How was it cut? Were trees planted afterward? Was the soil scarified? Was the slash burned? What forms of recreation have been allowed since the fire?

Hitting a snag

The Black-backed Woodpecker is not the only species that depends on a severe fire regime for survival, but its habits and requirements differ from many other species in that it is almost entirely reliant on these events.

In North American conifer forests, fire and other natural disturbances such as insect infestation, tree disease, and decay contribute to the creation of snags. In burned forests, standing dead trees exist along a continuum of decay, and the Black-backed Woodpecker profits from the entire spectrum. It dines on wood-boring beetle larvae that attack weakened trees, and it drills cavities in snags for its nests. After a few years, the beetles move on to newly disturbed patches, giving the bird a narrow window of opportunity to find suitable habitat for nesting and feeding.

The American Robin also thrives after severe fire. This nest demonstrates the value of broken-top snags after fire. Credit: Richard Hutto.

To benefit wildlife, current Forest Service guidelines call for snag retention at a rate of six to 10 trees per hectare (2.5 acres). This recommendation was based on research conducted in managed forests with frequent fire return rates and moderate to low fire intensity. The current guideline does not take into account a number of variables, such as successional age and forest type, which are crucial in maintaining good habitat for the Black-backed.

Hutto's research clearly documents evidence of the negative effects of salvage logging on the Black-backed Woodpecker. Even light salvage logging in burned forests decreases nesting opportunities for this snag-nesting species.

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Hutto recommends, whenever possible, that the natural regime of severe canopy fire in western conifer forests particularly, and in moderate to mild severity fire in other forest types, should be allowed to run its course.

Gleaning information through research

Though the Black-backed Woodpecker (Picoides arcticus) is not endangered, the USDA Forest Service ranks it as a sensitive species, and in certain states it is considered a species of special concern. It is a primary cavity nester and a member of the bark-gleaning guild.

The Black-backed is a non-migratory bird that relies on a nearby food source during its nesting season. Though no one knows for certain its natural life span, banded birds have been followed for up to eight years. "They probably disperse a couple of times in a lifetime," says Jennifer Woolf, a Ph.D. candidate in the Department of Ecosystem and Conservation Services at the University of Montana. These movements are in response to its quest for sites that

offer suitable nesting opportunities during the breeding season and feeding habitat the rest of the year. Occasional forays outside the normal range, termed irruptions, are likely responses to feeding opportunities.

Woolf's Master's thesis explored the short-term effect on the responses of birds and small mammals such as voles and chipmunks of fuel reduction treatments aimed at restoring Ponderosa pine forests. A history of fire exclusion on the experimental sites has led to an increase in Douglas fir.

Woolf gathered data on birds during the nesting seasons, May-June, of 2001 and 2002 on the University of Montana's Lubrecht Experimental Forest and adjacent land managed by the Montana Department of Natural Resources and Conservation (MDNRC). The research was conducted as part of the JFSP National Fire/Fire Surrogates study at Lubrecht.


Credit: Richard Hutto.

The area had been logged in the early 1900s and subsequently no fires had occurred. MDNRC is implementing a standard fuel reduction/forest restoration plan that involves commercial thinning followed by prescribed fire. Woolf compared sites that had been treated to control sites that did not receive a treatment.

Woolf did find evidence of bark-gleaning by the Black-backed in these experimental sites. "They were there and they were foraging, but we don't know if they were nesting," she says.

For her doctoral dissertation, Woolf is using genetic analysis to help determine the population structure and dispersal of the Black-backed Woodpecker from Oregon to Quebec. Using blood samples from the birds' brachial veins, she is probing the messages its mitochondrial DNA (mtDNA) can send us about the bird's history from the Ice Age to the 21st century. "With DNA we can see what families of birds are clustered together and related to the others," Woolf says.

The evolutionary clues pinpointed by mtDNA analysis promise a glimpse into the ancient history of this species that colonized the forests as the glaciers melted.

Further Information: Publications and Web Resources

Hutto, Richard L. "Understanding the influence of local and landscape conditions on the occurrence and abundance of Black-backed Woodpeckers in burned forest patches." Final Report – Joint Fire Science Program, 30 October 2007. http://avianscience.dbs.umt.edu/documents/finalreport2007_000.pdf

Hutto, Richard L. Portraits in Black Video available through the Avian Fire Research Program site: http://avianscience.dbs.umt.edu/research_avianfire.htm

Management Implications

- Refuges such as Glacier National Park provide good habitat for fire-dependent species from the bottom to the top of the food chain. A Wildland Fire Use policy that allows stand-replacing fire there can be beneficial to the Black-backed Woodpecker.
- With a better understanding of the fire cycle and of wildlife, land managers can learn to mimic natural fire disturbance regimes in managed forests to achieve a balance of economic and ecosystem services.
- Wood boring beetles may be detrimental to commercial timber operations, but they are a critical source of forage for the Black-backed and other birds.
- Resource managers need to document to the extent possible pre-fire forest conditions including harvest history, use of prescribed fire, or other management scenarios. Historical information is crucial to inform new research and give an accurate assessment of the effects of various strategies
- Severe fires are necessary for species such as the Black-backed Woodpecker.
- Thinning, moderate severity prescribed burning, or a combination may provide foraging opportunities, but may not provide nesting opportunities for the Black-backed Woodpecker.
- There is an urgent need for careful documentation of past land-use activities.

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Cornell Lab of Ornithology, All about Birds, (includes a link to its calls): http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Black-backed_Woodpecker.html

Reel, Sue. Web page, Life after a Fire: How Wildfires Affect Plants and Animals on the Lolo National Forest. http://www.fs.fed.us/r1/lolo/resources-natural/wildlife/after-fire/index.htm

Scientist Profiles

Richard L. Hutto is the Director of the Avian Science Center and Professor in the Division of Biological Sciences at the University of Montana. He specializes in research on local and landscape level conditions as they relate to the suitability of habitat for avian species and in the role of human-caused disturbances and of wildfire on conifer forests.

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Jennifer Woolf is a Ph.D. candidate in the Department of Ecosystem and Conservation Sciences at the University of Montana. Her doctoral research in wildlife biology is focused on the population connectivity and conservation of Black-backed Woodpeckers.

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Results presented in JFSP Final Reports may not have been peer-reviewed and should be interpreted as tentative until published in a peer-reviewed source.

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Joint Fire Science Program
Manager's Viewpoint
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Understanding the Influence of Local and Landscape Conditions on the Occurrence and Abundance of Black-Backed Woodpeckers in Burned Forest Patches

Written By: Lara Durán

Purpose of this opinion piece

Manager's Viewpoint is an opinion piece written by a fire or land manager based on information in a JFSP final report and other supporting documents. This is our way of helping managers interpret science findings. If readers have differing viewpoints, we encourage further dialogue through additional opinions. Please contact Tim Swedberg to submit input (timothy_swedberg@nifc.blm.gov). Our intent is to start conversations about what works and what doesn't.

Problem

Throughout much of this country's West and interior West, wildfire is the predominant disturbance agent. Historically, native wildlife species have evolved in environments that received an average annual occurrence of wildfire. Today, many native species that are dependent on wildfires—or wildfire-created habitats—are now restricted in their distribution to such conditions. The suppression of wildfires the past 70 years may have placed many of these fire-dependent species at risk. Past excessive fire suppression has also resulted in the occurrence of more severe fires than would have occurred historically. This has necessitated fuel reduction treatments: to prevent unnaturally severe fires, to restore site productivity on heavily burned areas, and to protect residual live trees within burned area perimeters. Our land and fire managers must accomplish these activities while also meeting the needs of fire-dependent species.

Application by Land Managers: New Paradigms and Practices

The results from this extensive study on black-backed woodpeckers and other inland forest bird species may compel land managers to develop new paradigms and practices that reflect bird ecology in burned and harvested forests.

Traditionally, only wildlife biologists would be motivated to read and apply this kind of research. This project, however, goes beyond the interested biologists by targeting foresters, fire and fuels managers, decision makers, and even future generations of land managers. While this study has local and geographic application specific to the north interior forests, its implications reach across the entire nation.

This study illustrates how the push toward fuel reduction and the need to minimize implementation costs by selling biomass before and after wildfire make meeting multiple use and public service missions—as well as biological conservation for some species—very challenging. This project challenges land managers to consider our traditional views of wildfire, our labeling system of fire regimes, our definitions of quality habitat, and our snag management guidelines. The study also delivers powerful critiques of our steadfast management practices that often seem to move more slowly than the related science progression and environmental changes. Unfortunately, while the environment and research evolves, the corresponding public land agencies seem to respond—try to play catch up—at a much slower pace.

Specifically, one of the challenges that this study addresses is how managers perceive and communicate the beneficial effects of wildland fire. In this sense, images of low-vegetation burn severity and mixed-vegetation burn severity fires immediately come to mind. More difficult to envision—and consequently sell to the public, decision-makers, and law makers—are the *beneficial* effects of stand replacement fire (Agee 2000). The study's findings regarding the obligate relationship of black-backed woodpecker (and many other unnamed species sampled) to stand replacement fire clearly communicates that this type of fire is a critical ecological process that we need to reconsider and make room for in our land management practices. This is especially true in northern latitudes, where black-backed woodpeckers occur.

The history of stand replacement fire in land management is somewhat confusing at best. The application of wildland fire for ecological benefit has a rich history that began in the 1960s. But it wasn't until the 1980s that fire policies included the application of stand replacement wildland fire (Agee 2000). Even today, limitations exist in our understanding and application of stand replacement fire and its role in fire regime classification. Many land mangers tend to think of fire regimes in single-category terms, as in "*the* stand-replacement regime" or "*the* surface fire regime."

Obviously, we still do not know everything about every historic fire activity or its effects across the West. Yet recent studies and biophysical modeling efforts using the Vegetation Dynamics Development Tool done for LANDFIRE shows that within individually labeled fire regimes variability in frequency, fire intensity, and size exists (Arno et al. 2000, Baker and Ehle 2001, Baker and Ehle 2003, Kaufmann et al. 2000, Rollins et al., Turner and Romme 1994, Whitlock et al. 2003, Veblen 2003a). Stand replacement fire, crown fire, or high-intensity fireline activity appears to be an element within all five fire regime categories. The standard labeling systems used to describe and classify fire regimes, however, does not reflect this variability (Agee 1993, Hardy et al. 2003).

Schmidt et al. 2002 begs the question: Do land managers need to reconsider how we apply fire regimes studies to include the variability that naturally occurs within each one, and to retrain our thought processes about fire ecology and fuels management?

This question is relevant not only to benefit black-backed woodpeckers, but also to determine where we expect—and even allow—stand replacement fire to occur. Generally, our concepts of stand replacement fire are confined to high elevation, backcountry areas such as designated Wilderness (Agee 2000). The 1995 Federal Fire Policy and its 2001 Review directs the full range of coordinated interagency "…management activities to achieve ecosystem sustainability…" and "…integration to fire as a natural process into land management planning,

including its ecological, social and legal consequences, using wildland fire as a natural process given specified prescriptions, and rehabilitate and restore ecosystems, while still protecting life." This policy includes direction for Appropriate Management Response and now the U.S. Forest Service Fire Doctrine, which may include increasing the acceptability of stand replacement wildland fire.

Even though research shows that stand replacement fire—ecologically critical for some species—historically occurred to some degree in low- and mid-elevation front country sites, many of us in the West are still reluctant to provide actual on-the-ground management opportunities that include stand replacement fire. At the same time, fires are getter larger, hotter, and more extreme, with stand replacement fire occurring at higher rates (Westerling et al. 2006).

One management case study comes from the Gunnison, Uncompaghre, and Grand Mesa National Forest. In 1999 and again in 2008, stand replacement prescribed fire was planned and is being implemented on the Gunnison Ranger District on approximately 171,000 acres for big horn sheep benefit in lodgepole pine and mixed conifer through a range of fire behavior fuel models (1, 2, 8, 9, 10, 12, and 13) (Currie pers. comm.). This impressive example proves how we can make room for this type of fire within our management context. It also reaffirms how we should consider stand replacement fire as a management practice in appropriate locations. Furthermore, this case study illustrates how we need to further the dialogue about the ecological role of stand replacement fire between researchers, wildlife biologists, fire and fuels managers, line officers, and the public. Given the climate and fire predictions, this dialogue should include discussing whether or not the current and expected rate of stand replacement fire is already transpiring on the landscape.

Stand Condition and Treatment

Equally important to obligate species with narrowly restricted habitats such as the black-backed woodpecker is not only that stand replacement fire occurs, but our need to address what the resulting stand structure will persist after the fire? Whether the burned areas were thinned before wildfire and whether post-fire salvaging occurs both have the potential to alter the structure and function of the post-fire stand. The important debate over aspects of salvage logging continues to be very controversial (Bengston and Fan 1999, DellaSala et al. 2006). As this study's principal investigator recommends, research and land management communities can collaboratively evaluate snag retention guidelines to include stand age, structure, tree species, density, elevation for live-green and separate guidelines for dead-black stands. For instance, silviculture prescriptions could address the variations in post-fire forest structure and understory vegetation patterns influencing bird fitness and success, especially in post-fire environments where temperature extremes can vary.

Robertson (2006) examines how management actions that aim to emulate natural disturbance processes and conditions utilizing snag guidelines and live tree management may inadvertently create conditions that appear to be of high quality but instead are really "ecological traps" for some individual species. Habitat management requires careful consideration of habitat features and environmental cues regarding what particular species require. This is a field of animal behavior and avian ecology research that needs more

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Clearly, certain elements of fuel reduction are going to remain viable management practices, particularly near and around wildland-urban interface areas. What is not evident, however, is how future funding trends, management capabilities, market values, and social expectations might drive future implementation of fuel reduction. The impacts of fuel reduction on fire behavior at localized and landscape scales are still being evaluated. We are much farther along in our understanding of fire behavior than we are on the effects of fuel reduction to hundreds of wildlife species. In fact, this study illustrates how biomass reduction may actually have deleterious effects on some wildlife species (Bull and Blumton 1999, Bull et al. 2007, Bury 2004).

In fact, this study illustrates how biomass reduction may actually have deleterious effects on some wildlife species

The issue of fuel reduction and lowered black-backed woodpecker occurrence following fire raises many interesting questions about this species. Such questions are relevant for wildlife biologists and fire and fuels managers. Why does harvesting before fire reduce the quality of habitat for black-backed woodpeckers? Is it because treatments tempered fire behavior, reduced vegetation burn severity, decreased the number of trees burned, altered the insect-prey population, or changed the hardness of wood for forage or nesting? Certainly, the density of black and dead trees matters to this species. Is there a threshold in which fuel reduction can still occur while ensuring the success of this bird? Additionally, how does this species cope in periods of low fire activity, which historically occurred in northern latitudes?

Regardless of the answers to these questions, the next move that wildlife biologists and fire and fuels managers must make on behalf of this species is to decide where fuel reduction and salvage logging is appropriate and where it is not. The concept that salvage logging and fuel reduction are not appropriate for every location is somewhat of a new and controversial topic, even though researchers keep reminding us of this notion's validity (Brown et al. 2004, Schoennagel et al. 2004, Veblen 2003a, Veblen 2003b).

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Manager Profile

Lara Durán is a Fire Planner for the Sawtooth National Forest in Idaho. Her previous positions included Fuels Specialist, Fire Prevention, and Wildlife Technician for the U.S. Forest Service in Colorado. Lara contributed to the JFSP Risk Roundtable, Manager's Reviews, and participated in the national pilot program Integrated Landscape Design to Maximize Fuel Reduction Effectiveness.

She earned a BA in Ecology from the University of Colorado at Boulder where she earned a National Science Foundation grant for undergraduate research in alpine plant development. She was a Wildlife and Plant Ecology Research Assistant at the University of Colorado, contributing to long-term studies on ponderosa pine, Abert squirrels, dwarf mistletoe, elk, American marten, and yucca plants. Since then, she's completed graduate courses in wildlife and plant ecology, law, and administration. She is interested in disturbance ecology and the effects to wildlife.

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